

## Oral Changes in Chronic Renal Failure Patients in One of the Regional Hospitals in Kosovo

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### Abstract

Chronic kidney disease (CKD) patients have a higher tendency to have oral diseases such as periodontitis, saliva flow changes, bleeding gums, dry mouth, and bad breath. Malnutrition, oxidative stress, and vitamin deficiency, such as complex vitamin B and vitamin C, are the main factors that may cause oral changes. This study aimed to evaluate the subjective oral health of a sample of 90 patients with chronic renal failure (CRF) in dialysis and determine the relationship between renal failure and oral changes. As a result, the most frequent answer was dry mouth after dialysis at around 73.3% of the patients, whereas 41.1% had tooth decay, 52% had bad breath, 35% had gingival bleeding and 22.2% have noticed tooth coloring. The comparison between male and female patients found significant differences in uremic fetor: male patients had an average score of 1.58, while female patients had 1.36 ( $P=0.0371$ ). Another significant difference was found for tooth discoloration: the average score for males was 1.67 and for females, 1.90 ( $P=0.0082$ ). Patients in urban areas had an average score for caries after dialysis of 1.40, while those in rural areas had 1.68 ( $P=0.01$ ). Patients with CRF should get multidisciplinary treatment. These patients require special consideration not only about dental treatment but also because of the side effects of the treatments they receive. A detailed evaluation and provision of good oral care after diagnosis of end-stage renal disease is more than necessary. (**International Journal of Biomedicine. 2023;13(4):306-311.**)

**Keywords:** chronic renal failure • uremic fetor • dry mouth

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### Abbreviations

CKD, chronic kidney disease; CRF, chronic renal failure

### Introduction

Numerous systemic diseases can affect patients' oral health. The prevalence of CKD worldwide is significantly increasing; therefore, oral health issues in these patients should be considered, since there are side effects of the drug intake and dental treatment, and so should the relationship between malnutrition, vitamin insufficiency, oxidative stress, and oral

changes that may be caused.<sup>(1,2)</sup> Mostly, some of these factors are related to the stage of the disease; furthermore, at the higher stage of the disease, oral health issues are more present. In recent studies, almost 90% of patients with CKD have oral health issues.<sup>(3)</sup> Reducing erythropoietin causes anemia, which causes atrophic tongue, petechiae, ecchymoses, and angular cheilitis.<sup>(4)</sup> The most common symptom in oral health in these patients is dry mouth, which can be caused by limited fluid intake (necessary to adjust the capacity of reduced renal failure), side effects of drug therapy, and decreased flow of saliva.<sup>(5)</sup> Patients also suffer from ammonia breath and a sensation of metallic taste in the mouth. This occurs because of high urea in the saliva that turns into ammonia, or another cause may be acidic saliva.<sup>(5)</sup>

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Furthermore, gingival inflammation has been reported to be caused by acidic saliva combined with poor oral hygiene.<sup>(6)</sup> Uremic stomatitis is a condition that appears in patients with high uremic blood values of 300 mg/ml, and it has 2 forms: erythematous form, which is characterized by burning mucositis, and pseudomembranous form, which is ulcerative and characterized by burning ulcers.<sup>(7)</sup>

Uremic frostbite occurs from crystal uremic formation in epithelial surfaces.<sup>(8)</sup> Candidiasis is also present in some patients because of decreased immunity, especially in patients with kidney transplants.<sup>(9)</sup> Enamel hypoplasia in the form of white and brown discoloration usually is seen in early renal disease; therefore, patients may notice spotting and brown teeth due to uremia and iron supplements.<sup>(10)</sup>

Renal osteodystrophy results from disorders in the metabolism of calcium, phosphorus, or vitamin D and increased parathyroid activity.<sup>(11)</sup> Intestinal absorption of calcium decreases in chronic renal failure (CRF) because the kidneys cannot convert vitamin D into its active form (1,25 dihydroxycholecalciferol). There is a corresponding phosphate retention, which ultimately leads to decreased serum calcium levels. This situation is accompanied by compensatory hyperactivity of the parathyroid gland, leading to increased secretion of urinary phosphates, decreased urinary calcium excretion, and increased calcium release from the bones.<sup>(10,12)</sup>

Metabolic renal osteodystrophy and compensatory hyperparathyroidism manifest in ways that include reduced trabeculae, demineralization, and appearance.<sup>(10)</sup> Other significant changes are reduction of cortical bone thickness, loss of lamina dura, lesions of radiolucent giant cells, expansion of the underlying skeleton, and metastatic soft tissue calcification.<sup>(13)</sup> Patients have an increased risk of jaw fracture due to trauma or oral intervention.<sup>(14)</sup> Other symptoms include healing disorders after tooth extraction, mobility of the tooth, gnathic disorders, hypoplasia, and denticles.<sup>(15)</sup> Radiographically, it is observed that the resorption of lamina dura leads to osteodystrophy.<sup>(16)</sup> Close cooperation between the dentist and nephrologists is required to treat patients.<sup>(17)</sup> Early assessment of the oral health status of patients with kidney disease is essential to eliminate potential foci of infection from the oral cavity. Before any surgery, patients must undergo a detailed oral assessment, and any necessary dental treatment should be planned and carried out carefully.

## Materials and Methods

Data was retrieved from patients in the Regional Hospital of Prizren, a city in Kosovo. In the research, a total of 90 patients participated. Among them, 48 were male (53.3%), while 42 were female (46.7%).

We used the following patient inclusion criteria: the diagnosis of verified CRF with anamnesis, physical examination, and completion of the dialysis criterion. Data related to patients' disease was gathered with an anonymous survey with 26 informative questions. We divided these questions into 3 groups: one group related to general information about patients, the second group related to information about CRF, and the third set related to oral health and possible oral manifestations.

Patients were informed about the purpose of the study questionnaire, participated voluntarily in the study, and gave informed verbal consent. An anonymous personal interview with patients was conducted by the clinician. Only patients who were able to follow the questions and offer answers were interviewed. Patients were interviewed only once during the study. There were no exceptions in the selection of patients regarding disease stage, age, and type of treatment at the time of the interview.

Statistical analysis was performed using statistical software package SPSS version 23.0 (SPSS Inc, Armonk, NY: IBM Corp). The normality of distribution of continuous variables was tested by the Kolmogorov-Smirnov test with the Lilliefors correction and Shapiro-Wilk test. For the descriptive analysis, results are presented as mean (M)  $\pm$  standard deviation (SD)/ standard error of the mean (SEM). For data with normal distribution, inter-group comparisons were performed using Student's t-test. Differences of continuous variables departing from the normal distribution, even after transformation, were tested by the Mann-Whitney U-test. Pearson's Correlation Coefficient (r) was used to determine the strength of the relationship between the two continuous variables. A probability value of  $P < 0.05$  was considered statistically significant.

## Results

In the research, a total of CRF 90 patients (48 male and 42 female) participated. Of them, 36(40%) had a low secondary education, 47(52.2%) had a higher secondary education, and 7(7.8%) had a university education. Among them, 7(7.8%) were unmarried and 83(92.2%) were married. Regarding the place of residence, 30(33.3%) were from the city, and 60(66.7%) were from the rural areas (Table 1).

**Table 1.**

**Baseline characteristics of study population.**

Educational level	N	%
Low secondary education	36	40.0
Higher secondary education	47	52.2
University education	7	7.8
Marital status	N	%
Single	7	7.8
Married	83	92.2
Place of residence	N	%
Urban	30	33.3
Rural	60	66.7
Gender	N	%
Male	48	53.3
Female	42	46.7

Regarding uremic fetor, 47(52.2%) responded with "Yes" and 43(47.8%) responded with "No"; 23(25.6%) patients had

a metallic taste, while 66(73.3%) did not; and 1(1.1%) did not respond. Thirty-two (35.6%) of the respondents expressed having gingival bleeding, while 58(64.4%) did not. Regarding the frequency of toothbrush replacement, 24(26.7%) stated that they replace it every 3 months, 27(30%) every 6 months, 35(38.9%) every year; 3(3.3%) do not have toothbrushes, and 1(1.1%) did not provide an answer. Twenty (22.2%) patients color their teeth, while 70(77.8%) do not. Many respondents (42.2%) feel thirsty during the day, while 36(40%) feel thirsty after dialysis, and fewer (16.7%) experience thirst at night. Sixty-six (73.3%) patients stated they had a dry mouth, while 24(26.7%) did not. After dialysis, 37(41.1%) have tooth decay, while 53(58.9%) do not (Table 2).

**Table 2.**

**Oral subjective characteristics and changes in patients with CRF.**

Uremic fetor	N	%
Yes	47	52.2
No	43	47.8
Metallic taste	N	%
Yes	23	25.6
No	66	73.3
N/A	1	1.1
Gingival bleeding	N	%
Yes	32	35.6
No	58	64.4
Frequency of toothbrush replacement	N	%
Every 3 months	24	26.7
Every 6 months	27	30.0
Every year	35	38.9
No toothbrush	3	3.3
N/A	1	1.1
Bad breath	N	%
Alcohol	1	1.1
Tobacco	16	17.8
Tobacco, Alcohol	1	1.1
No	72	80.0
Teeth staining	N	%
Yes	20	22.2
No	70	77.8
When you feel most thirsty?	N	%
During dialysis	1	1.1
During the day	38	42.2
During the night	15	16.7
After dialysis	36	40.0
How often do you brush your teeth?	N	%
1 time a day	46	51.1
2 times a day	39	43.3
3 times a day	1	1.1
Never	4	4.4
Dry mouth	N	%
Yes	66	73.3
No	24	26.7
Tooth with caries after dialysis	N	%
Yes	37	41.1
No	53	58.9

**Table 3.**

**The comparison between male and female patients with CRF in terms of oral changes.**

Parameter	Gender	N	Mean	SD	SEM
Quality of life with dialysis	Male	47	1.11	0.312	0.045
	Female	42	1.14	0.354	0.055
Last dental visit	Male	48	2.77	1.259	0.182
	Female	42	2.81	1.254	0.194
Uremic fetor*	Male	48	1.58	0.498	0.072
	Female	42	1.36	0.485	0.075
Metallic taste	Male	47	1.79	0.414	0.060
	Female	42	1.69	0.468	0.072
Gingival bleeding	Male	48	1.69	0.468	0.068
	Female	42	1.60	0.497	0.077
Brush replacement frequency	Male	48	3.23	0.951	0.137
	Female	42	3.10	0.850	0.131
Bad breath***	Male	48	3.29	0.988	0.143
	Female	42	3.95	0.309	0.048
Teeth staining**	Male	48	1.67	0.476	0.069
	Female	42	1.90	0.297	0.046
When do you feel most thirsty?	Male	48	2.83	0.930	0.134
	Female	42	3.10	0.932	0.144
How often do you brush your teeth?	Male	48	1.67	0.859	0.124
	Female	42	1.50	0.552	0.085
Dry mouth	Male	48	1.29	0.459	0.066
	Female	42	1.24	0.431	0.067
Tooth with caries after dialysis	Male	48	1.60	0.494	0.071
	Female	42	1.57	0.501	0.077

\* -  $P=0.0371$ , \*\* -  $P=0.0082$ , \*\*\* -  $P=0.000$ .

In the following results, we analyzed the comparison between male and female patients in terms of Quality of Life on Dialysis, Last Dental Visit, Uremic Fetor, Metallic Taste, Gingival Bleeding, Frequency of Brushing, Bad Breath, Tooth Discoloration, Thirst Sensation, Frequency of Tooth Cleaning, Dry Mouth, and Tooth Decay after Dialysis (Table 3). Based on the descriptive results, we can see that in terms of Quality of Life on Dialysis, male patients had an average score of 1.11, while female patients had 1.14. Regarding the Last Dental Visit, male patients had a slightly lower average score of 2.77 than females (2.81). In terms of Fetor, males had an average score of 1.58, while females had 1.36. For Metallic Taste, males had an average score of 1.79, females 1.69. There were also slight differences in Gingival Bleeding, where males had an average score of 1.69 whereas females had an average score of 1.60. Similarly, in the Frequency of Brushing, males had an average score of 3.23, while females had 3.10. In terms of Tooth Discoloration, males had an average score of 1.67,

while females had 1.90. As for Thirst Sensation, males had an average score of 2.83, while females had 3.10. The average frequency of Tooth Cleaning for males was 1.67, whereas for females, it was 1.50.

Significant differences have been found in Uremic Fodor. Male patients had an average score of 1.58, while female patients had 1.36 ( $P=0.0371$ ). Significant differences were also found in Bad Breath. Male patients had an average score of 3.29, while female patients had 3.95 ( $P=0.000$ ). We found another significant difference for Tooth Discoloration. The average score for males was 1.67 and for females, 1.90 ( $P=0.0082$ ).

Below is presented the comparison between patients from urban and rural areas (Table 4), where, based on the descriptive results, we have a more pronounced difference in teeth with caries after dialysis. Patients in urban areas had an average score of 1.40, while those in rural areas had 1.68 ( $P=0.01$ ). In other cases, there are no significant differences between patients from urban and rural areas.

**Table 4.**

**The comparison between CRF patients from urban and rural areas in terms of oral change.**

Parameter	Residence	N	Mean	SD	SEM
Quality of life with dialysis	Urban	30	1.07	0.254	0.046
	Rural	59	1.15	0.363	0.047
The last visit to the dentist	Urban	30	2.40	1.303	0.238
	Rural	60	2.98	1.186	0.153
Uremic fetor	Urban	30	1.40	0.498	0.091
	Rural	60	1.52	0.504	0.065
Metallic taste	Urban	30	1.70	0.466	0.085
	Rural	59	1.76	0.429	0.056
Gingival bleeding	Urban	30	1.63	0.490	0.089
	Rural	60	1.65	0.481	0.062
Brush replacement frequency	Urban	30	3.03	0.850	0.155
	Rural	60	3.23	0.927	0.120
Bad breath	Urban	30	3.60	0.814	0.149
	Rural	60	3.60	0.827	0.107
Teeth staining	Urban	30	1.67	0.479	0.088
	Rural	60	1.83	0.376	0.049
When you feel most thirsty	Urban	30	2.87	0.973	0.178
	Rural	60	3.00	0.921	0.119
How often do you brush your teeth?	Urban	30	1.70	0.651	0.119
	Rural	60	1.53	0.769	0.099
Dry mouth	Urban	30	1.20	0.407	0.074
	Rural	60	1.30	0.462	0.060
Tooth with caries after dialysis*	Urban	30	1.40	0.498	0.091
	Rural	60	1.68	0.469	0.061

\*-  $P=0.01$

In our study, we found significant differences only in the case of teeth with caries after dialysis between patients from urban and rural areas. Indeed, there was a correlation between patients with gingival bleeding and teeth with cavities after dialysis ( $r=0.323$ , 2-tailed  $P=0.002$ ). This indicates that gingival bleeding increases the likelihood of having teeth with cavities after dialysis.

## Discussion

The present study found that the most common symptom in patients with CRF is dry mouth followed by bad breath and tooth decay. Previous studies show that patients with CRF have a higher incidence of oral conditions.<sup>(18-20)</sup> Dry mouth in patients who are attending hemodialysis can be caused by uremia and dehydration because of the restriction of fluid intake.<sup>(21,22)</sup> Meanwhile, uremia is one of the dominant factors that can lead to decreased lymphocyte response, damage of granulocytes, and immunity suppression.<sup>(23,24)</sup>

Decreased salivary flow has an impact on dry mouth and halitosis. Also, it damages the patients' quality of life since they have speaking, chewing, and swallowing problems.<sup>(25-28)</sup> Bad breath is one of the most common subjective and objective symptoms in patients with CRF. The measurements that are made with organoleptic tests and gas halitosis were observed. Furthermore, hydrogen sulfide tends to be one of the most significant factors that cause halitosis that comes from tongue coating.<sup>(29)</sup>

Kao et al.,<sup>(21)</sup> in their study, concluded that there is significantly poorer salivary function in patients with end-stage renal disease, which is compatible with our results. Furthermore, in our study, tooth decay, according to patients, is increased. Contrary to our findings, Chao et al. found that tooth decay doesn't seem to undergo any changes; even though there was high colonization of *Streptococcus mutans* it was not an indication of increased caries.<sup>(30)</sup> In most studies, salivary urea is observed to be one of the most important factors that increases the pH of the saliva and protects the tooth from demineralization.<sup>(31,32)</sup>

The present study shows the possible oral symptoms in patients with renal failure that attend hemodialysis. According to the study, oral manifestations are frequent, and among the affecting factors are age, disorders from kidney disease and/or accompanying diseases, side effects of the treatments they receive, and poor oral hygiene. People over 60 are more affected by the side effects of drugs used in therapy and the changes in the body that accompany this age. This study has limitations since we did not examine the patients, and further research should be done.

## Conclusion

Patients undergoing dialysis treatment show marked oral changes and changes in the flow of saliva; therefore, it is necessary to offer treatment and supervision by the dental staff. Untreated dental infections in patients with renal failure may contribute significantly to morbidity, as they have a compressed immune system. The awareness of patients under

dialysis treatment should be increased. Dentists should be informed about possible oral manifestations and prevention.

## Competing Interests

The authors declare that they have no competing interests.

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